Report
on
The Effect of Upland Game Management
on
Populations of Breeding Birds
in
Northwestern Ohio

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THE EFFECT OF UPLAND GAME MANAGEMENT ON POPULATIONS OF BREEDING BIRDS IN NORTHWESTERN OHIO

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Abstract: An investigation was undertaken to determine whether or not upland game management increases populations of non-game species of birds. The Resthaven Wildlife Area near Castalia, Ohio, was chosen as the experimental area. A similarly sized section of typical farmland in Sandusky County was chosen to be the control area. A 20-stop sampling route was set up in each area to determine the species present and their relative abundance. A total of 69 species were recorded at Resthaven and 55 at Erlin.

Statistical analysis of the data gathered indicated that 32 species had significant population differences between areas. Twenty-three species were significantly more abundant at Resthaven and nine were significantly more abundant at Erlin.

Wildlife managers generally agree that management for game animals is also beneficial for non-game animals. With recent trends toward intensified land use and agricultural practices and the rapid destruction and alteration of wildlife habitat, the truth of this belief is becoming increasingly important. Until now, very little has been done to prove or disprove whether or not game management is benefical to non-game animals.

This investigation was an attempt to evaluate the effectiveness of upland game management in increasing populations of non-game birds. The method of evaluation chosen was a roadside census. This method has been successfully used for various species of wildlife such as small birds (Howell 1951, Robbins and Van Velzen 1966), American Woodcock (Kozicky et al. 1954), Ruffed Grouse (Dorney et al. 1958), Mourning Dove

(McClure 1939), Red-winged Blackbird (Hewitt 1967), and others.

I should like to acknowledge Dr. T. W. Townsend, Ohio State University, for his assistance and guidance throughout the entire course of this study, and A. Cannon and J. Keener, Ohio Division of Wildlife, for their ideas and advice which got this study started. Special thanks goes to W. Arndt, without whose diligent help the field data could not have been collected.

STUDY AREAS

Resthaven Wildlife Area

The Resthaven Wildlife Area (hereafter referred to as Resthaven) is situated in the lake plains region near the town of Castalia in Erie County, Ohio. Resthaven today covers 2,210 acres (Anonymous 1969) and lies entirely within an area previously known as the Castalia Prairie (Foos 1971). The topography of the area is flat and poorly drained. The soil throughout Resthaven is of the Warner's muck type which consists of black, poorly drained organic material and marl (Hurst 1971). Mining for marl in the late 1800's left much of the area in a soil type for which there is no classification.

Resthaven was maintained as a game refuge from 1942 to 1951 when the area was opened to hunting (Hothem, personal communication). The area consists of diversified cover types including cropland interspersed among areas of permanent grass, low shrubs, woodlots, and ponds. For ease of handling, these cover types were broken into an artificial classification.

The cover types recognized were bottomland woodland, grassland, cropland, water, fencerow, and farmyard-residential. Farmyard-residential is not actually a cover type, but represents a distinct habitat type which should be distinguished from the others. The approximate acreage of each cover type and its characteristic plant species are given in Table 1, page 4. Figure 1, page 6, shows the distribution of various cover types in the Resthaven study area.

Erlin Area.-

The Erlin study area is located in the Erie-Huron Lake Plains region immediately southeast of the village of Erlin in Sandusky County, Ohio. The topography of the area is flat with a general slope toward the present level of Lake Erie. The soil consists of calcareous lucustrine materials and varies from a depth of 38 to 55 feet (Hough 1963).

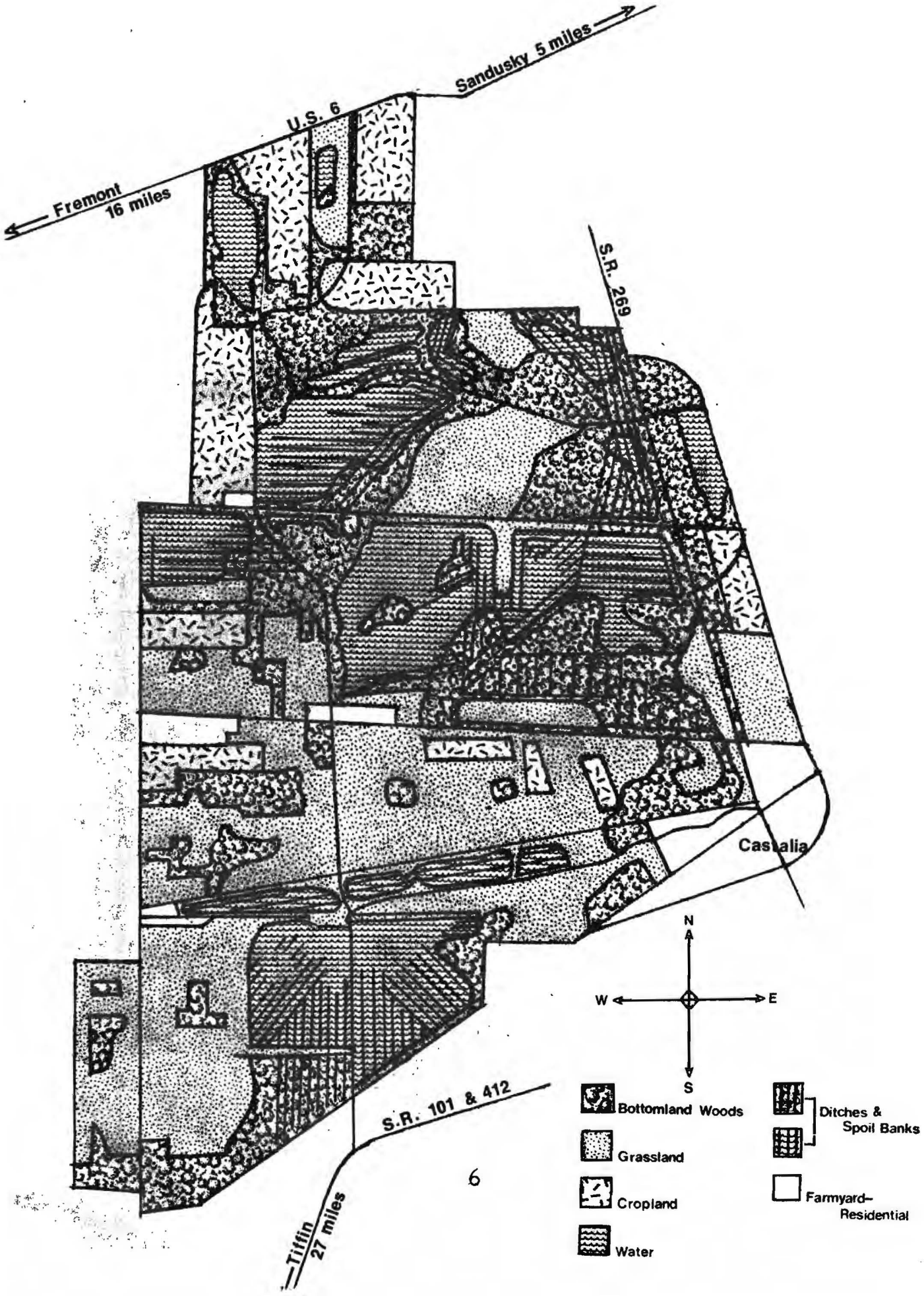
The Erlin area today is highly agricultural with most land being used for cash grain crops. In recent years several trends in land use have been noticed. The most obvious has been the disappearance of fence rows, woodlots, and odd areas (Ohio Soil and Water Conservation Needs Inventory 1971). Field sizes have increased and there has been a tendency toward uniform field shape. In addition , the acreage planted in cash grains has increased while the acreage planted in crop types that afford suitable wildlife cover has decreased.

The area was divided into cover types similar to the divisions used for the Resthaven area. The cover types

Table 1. Acreage and Characteristic Plants of the Cover Types Found Within the Resthaven Wildlife Area.

Cover Type	Characteristic Plants	Acres	Percent of Total
Bottomland Woodland	Cottonwood Sycamore Silver Maple	921.7	38.5
Grassland	Reed Grass Indian Grass Big Bluestem	784.3	32.8
Cropland	Corn Oats Soybeans	234.6	9.8
Water	Naiad Pondweed Mermaid-weed	352.4	14.7
Fencerow	Hawthorn Sumac Dogwood	6.0	0.3
Farmyard-Residential	Various horticultural trees and shrubs	93.3	3.9
Total		2,392.3	100.1

Figure 1. The Distribution of Cover Types Found Within the Resthaven Study Area.


Sandusky 5 miles
U.S. 6
Fremont
16 miles
S.R. 269
Castalia
N
W
E
S
S.R. 101 & 412
Tiffin
27 miles
Bottomland Woods
Grassland
Cropland
Water
Ditches &
Spoil Banks
Farmyard–
Residential

recognized were upland woodland, water, cropland, pasture, fencerow, and farmland-residential. Cropland was further divided into soybeans, corn, sugar beets, hay, small grains (wheat, oats, etc.), and fallow fields.

Several species characteristic of upland woodland are oaks, hickories, and maple. Characteristic plants for fencerows and farmland-residential were given in Table 1, page 4. The approximate acreages of the cover types found in the Erlin area are given in Table 2, page 8. The distribution of these cover types is shown in Figure 2, page 10.

One of the assumptions made in this investigation was that the Erlin area represented typical northwestern Ohio farmland. A comparison of the percentage of area in each major cover type in the Erlin study area with those for all of Sandusky County confirmed this assumption. The percentages for Erlin and Sandusky County respectively were cropland (88, 86), woodland (4.5, 7), pasture (3.2, 2), and other land (5.5, 5). The data for Sandusky County was taken from the Ohio Soil and Water Conservation Needs Inventory (1971).

METHODS

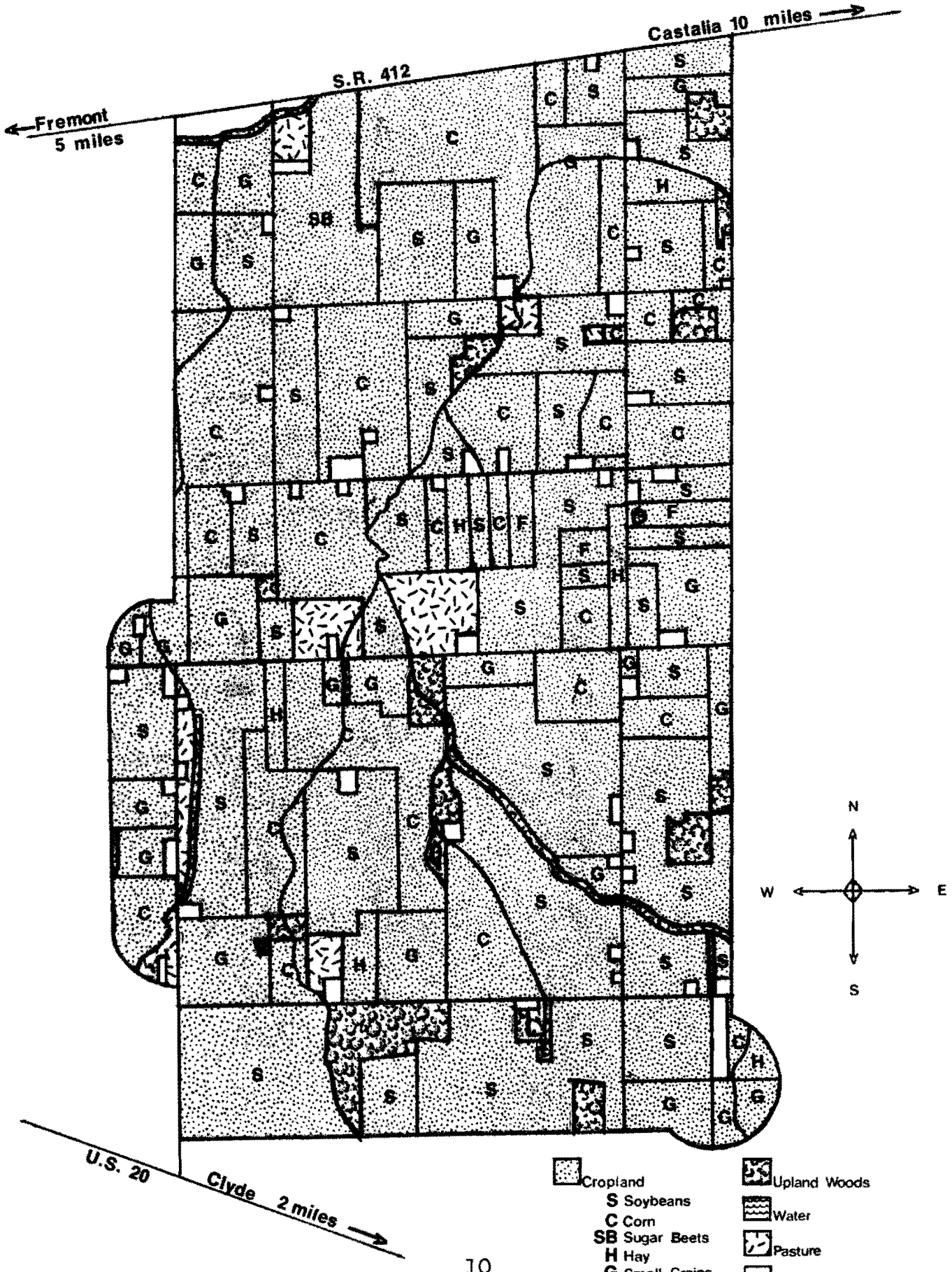
Selection of Study Areas, Sampling Routes, and Sampling Stops

The Resthaven Wildlife Area near Castalia, Ohio, was chosen as the test area because of its location, adaptability to a roadside survey, and past management practices. The major considerations in choosing the test area were (1) to minimize the time and gas required to get to and from the test area,

Table 2. Acreage of the Cover Types Found Within the Erlin Study Area.

Cover Type	Acres	Percent of Total
Upland Woodland	136.4	4.5
Water	2.9	.1
Cropland	2679.1	88.2
Soybeans	1243.7	40.9
Corn	796.0	26.2
Sugar Beets	103.1	3.4
Hay	68.9	2.3
Small Grains	435.8	14.3
Fallow Fields	31.6	1.0
Pasture	96.1	3.2
Fencerow	43.0	1.4
Farmyard-residential	80.3	2.6
Total	3037.8	100.0

Figure 2. The Distribution of Cover Types Found Within the Erlin Study Area.


Castalia 10 miles
S.R. 412
Fremont
5 miles
N
W
E
S
U.S. 20
Clyde 2 miles
Cropland
S Soybeans
C Corn
SB Sugar Beets
H Hay
G Small Grains
F Fallow Fields
Upland Woods
Water
Pasture
Farmyard-Residential

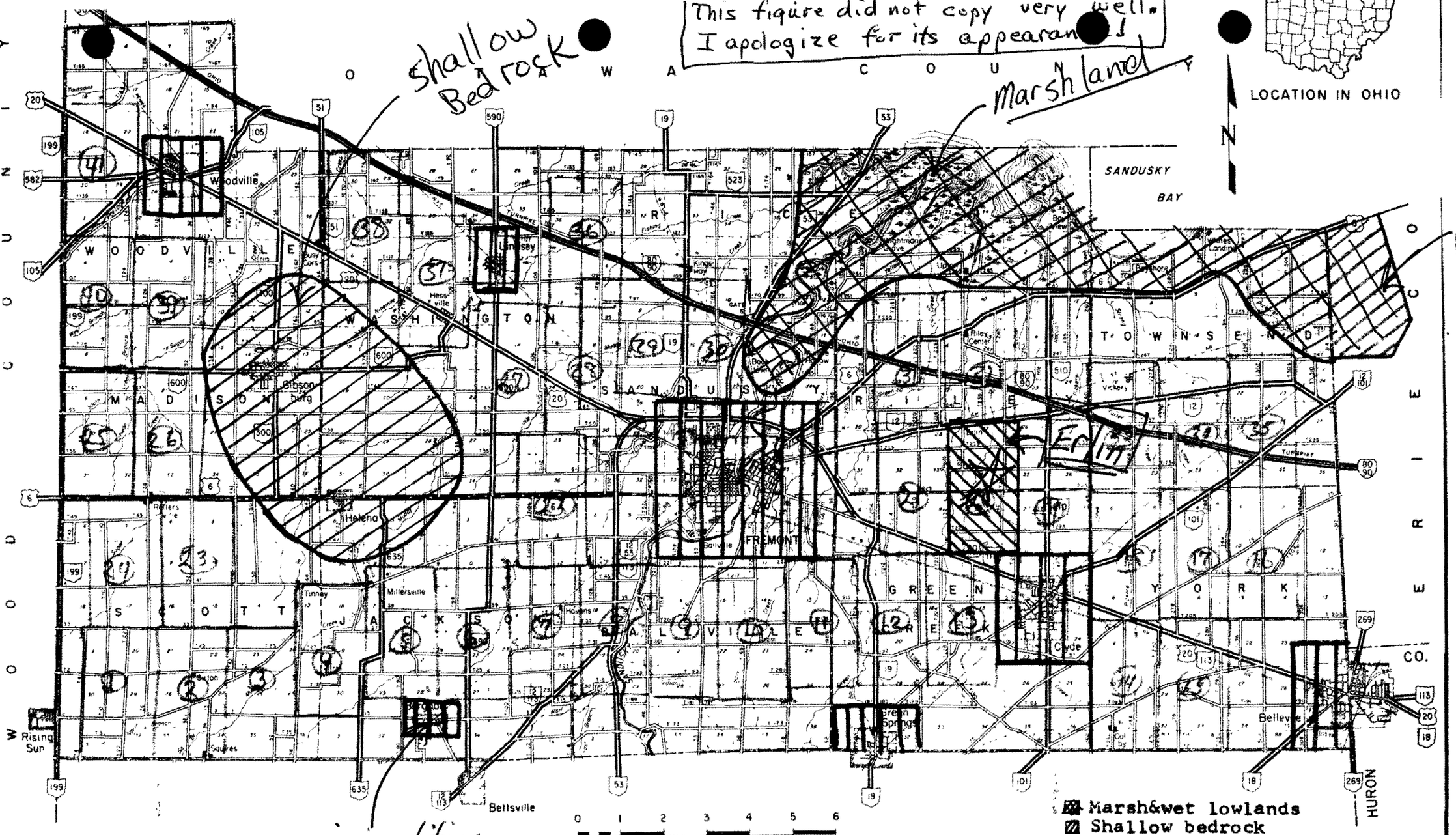
(2) to find an area which could be adequately sampled using a roadside census, and (3) to find an area where the management emphasis was on upland game. The Resthaven Wildlife Area met all of these considerations.

An agricultural area in Sandusky County was chosen at random to be the control area since agriculture is the most common land use practice in northwestern Ohio (Soil and Water Conservation Needs Inventory 1971). Those areas in Sandusky County which did not represent typical northwestern Ohio farmland were delineated on a map by the Sandusky County soil conservation agent. These areas represented municipalities, areas of shallow bedrock, and marshland along Lake Erie. The rest of Sandusky County was divided into sections approximately the same size as Resthaven. These sections were numbered, and one was chosen by means of random drawing. Figure 3, page 13, shows the location of the area selected.

The starting point for the route in each area was determined in advance to be the most northeasterly road entering the area. The routes were to proceed southerly on existing roads in a manner that provided the best coverage of the area.

Sampling stops were determined using a combination of random and systematic selection. The first stop was randomly located from one to four tenths of a mile from the starting point of the route. After the first stop was established, each proceeding stop was located four tenths of a mile along the designated route until 20 stops had been established. Keener (personal communication) suggested that 25+- stops make

Figure 3. Location of the Resthaven and Erlin Study Areas.



SANDUSKY COUNTY SOIL CONSERVATION DISTRICT

13

The District includes all of Sandusky County exclusive of incorporated cities, towns, and villages

- Marsh&wet lowlands
- Shallow bedrock
- Municipalities
- Sections of typical farmland
- ★ Erlin study area
- Resthaven study area

Total acreage approximate 254,500

an ideal route. The location of the last stop of the Resthaven route was determined in a similar manner to that used for the first stops. Figures 4 and 5, pages 16 and 18, show the location of the routes and stops within the Resthaven and Erlin areas respectively.

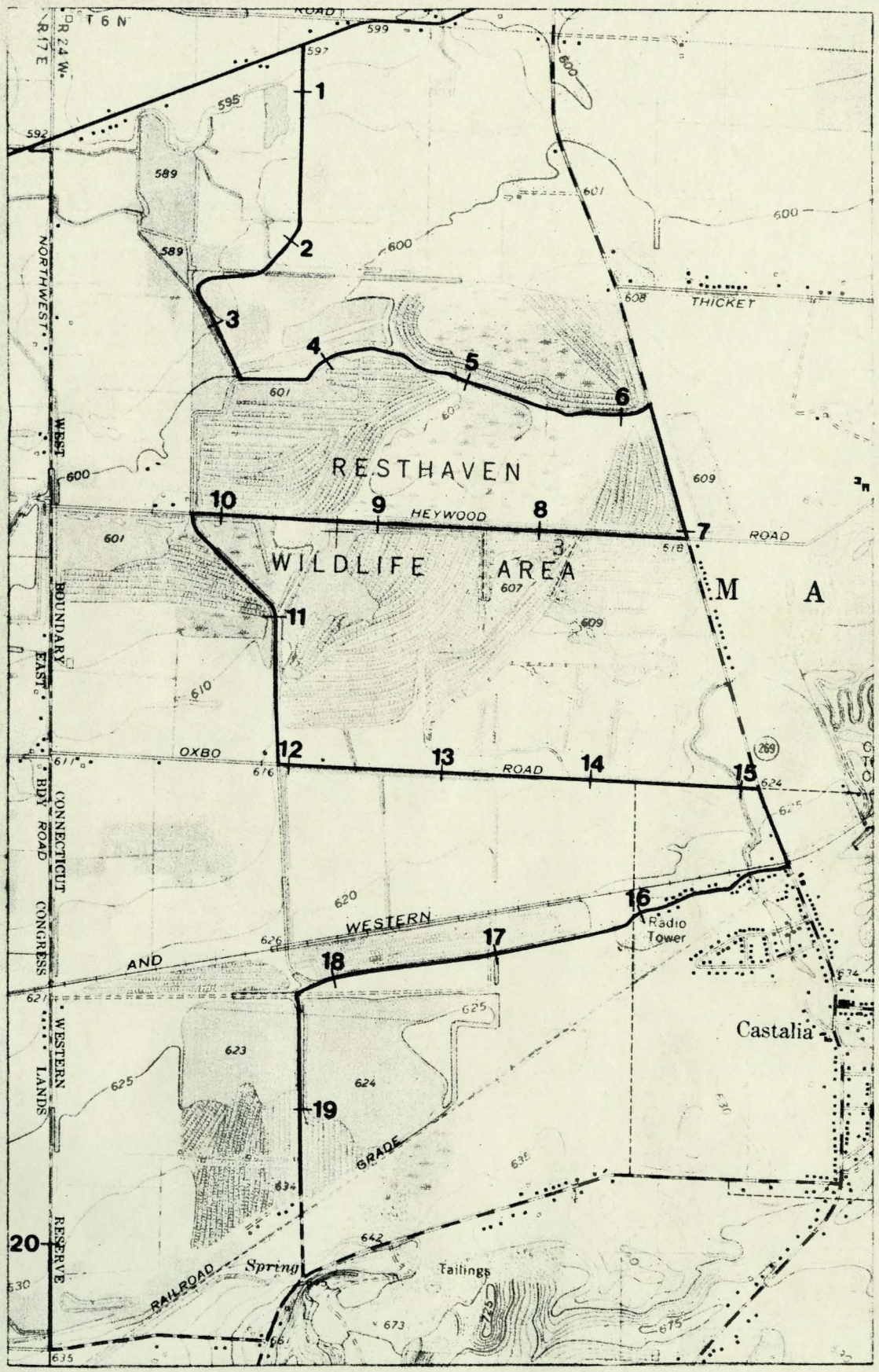
Sampling Procedure and Recording of Data

The sampling routes were run and data were recorded similar to that described by Robbins and Van Velzen (1966: 2-6). Routes were run on alternate days, Resthaven one day, Erlin the next, and each successive run of the same route was reversed. The routes were reversed to minimize the effect of time of day noted by Robbins and Van Velzen (1966) on the last stops of a route. Routes were covered on consecutive days with suitable weather conditions until both had been covered six times. The routes were not run on days with rain, fog, or wind speeds over 12 m.p.h.

The routes were started at sunrise. One person watched and listened for exactly five minutes at each stop while another person recorded the data. A taperecorder was used to verify field data which allowed the observer to utilize the full five minutes for observation with accurate recording of data.

The data sheets used were the same as those used in the National Breeding Bird Survey as described by Robbins and Van Velzen (1966: 3-5). The temperature, wind speed, and percentage of cloud cover were recorded at the start and completion of each route. The time at the beginning of each five-minute stop was also recorded.

Figure 4. Topographic Map of the Resthaven Wildlife Area Showing Census Route and Observation Stops. Contour Interval = 5 feet; Scale = 1:24,000


T 6 N
R 24 W
R 17 E
ROAD
NORTHWEST
WEST
BOUNDARY
EAST
BDY
ROAD
CONNECTICUT
CONGRESS
WESTERN
LANDS
RESERVE
RESTHAVEN
WILDLIFE AREA
HEYWOOD
ROAD
OXBO
ROAD
WESTERN
AND
RAILROAD
GRADE
THICKET
Radio Tower
Castalia
Spring
Tailings
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
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19
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589
592
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597
599
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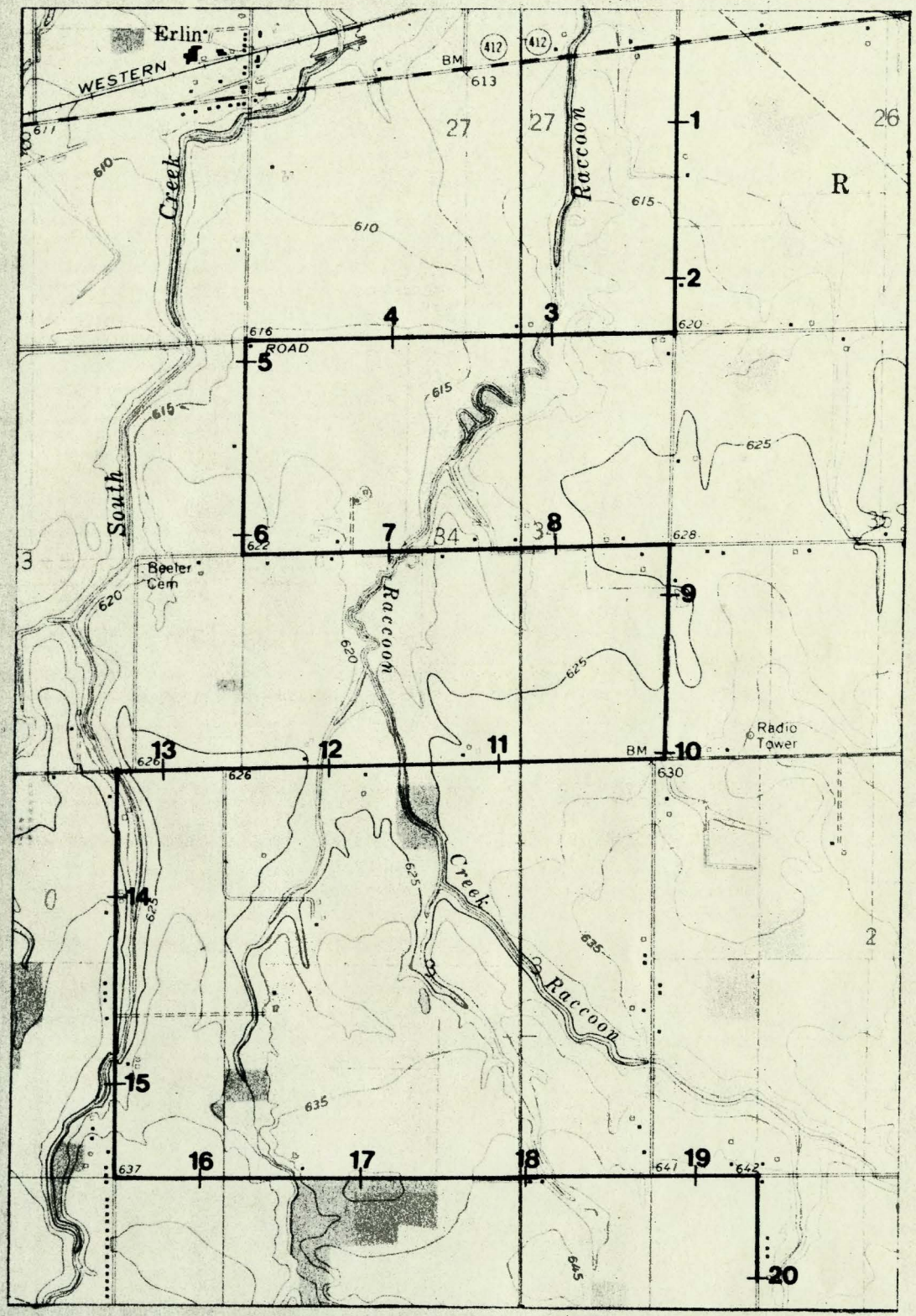
601
608
609
610
611
616
618
620
621
623
624
625
626
634
635
642
673
675

Figure 5. Topographic Map of the Erlin Study Area Showing Census Route and Observation Stops. Contour Interval = 5 feet; Scale = 1: 24,000


Erlin
WESTERN
BM
613
412
412
27
27
26
R
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
ROAD
Creek
Raccoon
South
Beeler
Cem
Radio
Tower
BM
610
611
615
616
620
622
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626
628
630
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637
641
642
645

All birds seen within two-tenths mile of a stop in all directions and all birds heard regardless of distance were recorded. The limiting distance for observation of two-tenths of a mile was judged as half the distance to the next stop. No effort was made to separate birds heard from birds seen. Only those birds seen or heard during the five-minute period were counted. Birds seen between stops were not counted unless seen at a subsequent stop.

The habitat type in which birds were seen was also recorded. Study areas were divided into cover types as described by Cannon (1968) with several modifications for ease in handling. Those birds heard but not seen and those birds seen in flight were recorded as unknown.

At the conclusion of each route, field data were entered on summary sheets. The total number of each species, the number of stops at which each species was recorded, and meteorological data were recorded.

Cover Mapping

Study areas were covered mapped similar to that described by Cannon (1968) using areal photographs supplemented with ground truth data. A dot grid was used on the cover maps to determine acreages, and a Map Measure was used to determine the amount of "edge." The Map Measure is a small, wheeled device which when run along a line determines length in inches. If the map scale is known, map distances can then be converted to any unit of ground distance.

RESULTS AND DISCUSSION

Sources of Bias in Sampling Procedure

Observer Bias.—Variation in the ability of observers is believed to be a major bias in roadside count surveys (Lack and Lack 1972, Nickolson 1931, Robbins and Van Velzen 1966). Differences in results often correspond to a difference of ability in observers rather than a difference in bird populations (Nickolson 1931). However, since the same person did all the observing in this study, the bias caused by differences of ability was reduced to a minimum. Lack of experience may have effected the total number of individuals or species recorded, but it should not have significantly effected the comparison of the areas .

Time of Day.—It is well known that most birds are more active soon after dawn than later in the day. Some species such as owls and goatsuckers, however, are most active before or at dawn (Robbins and Van Velzen 1966). There is no time when all species are at a peak of activity, so the observation period was of necessity a compromise.

The investigator considered a starting time of one-half hour before sunrise as suggested by Robbins and Van Velzen (1966) too early. Preliminary coverage of the routes indicated that light conditions one-half hour before sunrise on overcast days decreased the ability of the observer to see birds at the first several stops. Therefore routes were started exactly at sunrise (6:00-6:04 a.m. during the study period).

Keener (personal communication) indicated that most singing decreases appreciably after 9 a.m. Allowing five minutes per stop and two minutes between stops, approximately two and one third hours were needed to complete a route. This time period allowed the routes to be finished well before 9 a.m. and before any marked decrease in bird activity.

Time of Year.—The time of year also affects the number of birds seen or heard (Robbins and Van Velzen 1966). Males are often more conspicuous during the breeding season while actively defending territories. Conversely, incubating females are inconspicuous and may be easily overlooked. Since different species and individuals of the same species often breed at different times, much variability exists.

As the summer progresses, an increasing number of young birds are sampled, and some species such as blackbirds begin to flock. However, in this study only relative abundance and not actual numbers of birds was needed. Assuming that the effects of time of year were equal on both areas, they could be neglected without seriously altering the reliability of the results.

Weather.—Adverse weather conditions influence the number of birds recorded during roadside counts (Hewitt 1967, Kolzicky et al. 1954, Robbins and Van Velzen 1966). A wind speed of 12 m.p.h. was considered the maximum allowable speed during the coverage of a route. Greater speeds decreased bird activity and lowered the number of birds recorded. The resultant bias was kept to a minimum by avoiding coverage on days with adverse weather conditions.

Bird Fauna of Resthaven

A total of 69 species were recorded at Resthaven on six runs of the census route between June 11 and June 28 (Table 3). The average number of species per route was 52.3. No species was recorded at all stops. The Indigo Bunting came closest with one or more individuals being recorded at 10, stops. The Indigo Bunting was followed closely by the Starling (94 stops), Common Grackle (91 stops), and the Song Sparrow (85 stops).

It must be stressed that the average number of each species presented in Table 3 represents relative abundance only rather than exact numbers. Also, the data do not represent the abundance of one species in relation to others; those species most readily observed on roadside counts will be found in greater numbers than those species which are inconspicuous or hard to identify.

Bird Fauna of Erlin

A total of 55 species were recorded on six runs of the route at Erlin from June 12 to June 29 (Table 3). The average number of species recorded per route was 41.1. The Starling was recorded at the most stops (117). It was followed by the Common Grackle (113), House Sparrow (109), and the Red-winged Blackbird (104). The common occurrence of these species may have significant bearing since all four of these species are considered locally destructive to some type of agricultural crop (Martin et al. 1951).

Table 3. Total Individuals, Average Individuals Per Route, and Frequency of Detection, by Species, for the Resthaven and Erlin Study Areas.[a]

Species	Study Area: Resthaven Total Indiv.	Resthaven Average per Route[b]	Resthaven No. of Stops[c]	Erlin Total Indiv.	Erlin Average per Route	Erlin No. of Stops
Great Blue Heron	9	1.5	8	2	.3	2
Green Heron	14	2.3	13	-	-	-
Blk.-cr. Nt. Heron	1	.2	1	-	-	-
Mallard	75	12.5	19	46	7.6	8
Wood Duck	6	1.0	2	-	-	-
Redhead	14	2.3	5	-	-	-
Pintail	1	.2	1	-	-	-
Red-tailed Hawk	1	.2	1	2	.3	2
American Kestrel	1	.2	1	13	2.1	9
Bobwhite	20	3.3	15	19	3.1	14
Ring-necked Pheasant	1	.2	1	21	3.5	19
Killdeer	13	2.1	9	81	13.5	49
Rock Dove	19	3.1	8	50	8.3	10
Mourning Dove	136	22.6	74	127	21.1	59
Yellow-bill Cuckoo	36	6.0	27	1	.2	1
Common Nighthawk	-	-	-	2	.3	2
Chimney Swift	6	1.0	5	85	14.1	30
Ruby-t. Hummingbird	2	.3	2	-	-	-
Belted Kingfisher	6	1.0	5	2	.3	2
Common Flicker	50	8.3	38	9	1.5	9
Red-bell. Woodpecker	4	.6	3	-	-	-
Red-hd. Woodpecker	35	5.8	26	2	.3	2
Hairy Woodpecker	3	.5	2	-	-	-
Downey Woodpecker	36	6.0	26	1	.2	1
Eastern Kingbird	10	1.6	7	3	.5	3
Gt. Crest Flycatcher	9	1.5	7	13	2.1	2
Willow Flycatcher	45	7.5	33	7	1.1	6
E. Wood Peewee	24	4.0	19	9	1.5	8
Horned Lark	-	-	-	141	23.5	53
Tree Swallow	56	9.3	31	1	.2	1
Rough-wg. Swallow	4	.6	3	16	2.6	8

[a]Common names follow The American Ornithologists' Union (AOU) 1957 check-list of North American Birds. Changes include those made by the thirty-second revision of this list published in Auk, 90: 411-419, April 1973.

[b]All averages were rounded to nearest tenth.

[c]Out of a possible 120.

Table 3. Total Individuals, Average Individuals Per Route, and Frequency of Detection, by Species, for the Resthaven and Erlin Study Areas (continued).

Species	Study Area: Resthaven Total Indiv.	Resthaven Average per Route	Resthaven No. of Stops	Erlin Total Indiv.	Erlin Average per Route	Erlin No. of Stops
Barn Swallow	16	2.6	4	104	17.3	51
Purple Martin	2	.3	2	14	2.3	6
Blue Jay	52	8.6	34	39	6.5	27
Common Crow	18	3.0	13	20	3.3	14
Carolina Chickadee	1	.2	1	-	-	-
Tufted Titmouse	15	2.5	13	3	.5	2
White-br. Nuthatch	-	-	-	1	.2	1
House Wren	158	26.3	78	74	12.3	56
Carolina Wren	5	.8	3	-	-	-
Mockingbird	-	-	-	1	.2	1
Gray Catbird	98	16.3	63	9	1.5	8
Brown Thrasher	12	2.0	10	10	1.6	9
Robin	163	27.1	76	224	37.3	92
Wood Thrush	34	5.6	23	3	.5	3
Veery	6	1.0	4	-	-	-
Cedar Waxwing	102	17.0	39	-	-	-
Starling	737	122.8	94	1731	288.5	117
White-eyed Vireo	1	.3	1	-	-	-
Yellow-thr. Vireo	7	1.1	7	-	-	-
Red-eyed Vireo	31	5.1	27	3	.5	3
Warbling Vireo	53	8.8	29	-	-	-
Yellow Warbler	94	15.6	52	5	.8	4
Com. Yellowthroat	78	13.0	55	22	3.6	21
Yellow-br. Chat	42	7.0	28	-	-	-
Am. Redstart	8	1.3	5	-	-	-
House Sparrow	234	39.0	43	1139	189.8	109
Bobolink	-	-	-	12	2.0	7
E. Meadowlark	5	.8	4	97	16.1	55
Red-wg. Blackbird	119	19.8	56	571	95.1	104
Orchard Oriole	2	.3	2	-	-	-
Northern Oriole	120	20.0	70	10	1.6	10
Common Grackle	371	61.8	91	999	166.5	113
Brown-hd. Cowbird	166	27.6	66	139	23.1	54
Scarlet Tanager	8	1.3	5	-	-	-
Cardinal	78	13.0	55	40	6.6	27
Rose-br. Grosbeak	7	1.1	5	-	-	-
Indigo Bunting	266	44.3	101	43	7.1	30

Table 3. Total Individuals, Average Individuals Per Route, and Frequency of Detection, by Species, for the Resthaven and Erlin Study Areas (continued).

Species	Study Area: Resthaven Total Indiv.	Resthaven Average per Route	Resthaven No. of Stops	Erlin Total Indiv.	Erlin Average per Route	Erlin No. of Stops
Am. Goldfinch	280	46.6	73	131	21.8	46
Rufous-side Towhee	48	8.0	33	1	.2	1
Savannah Sparrow	1	.2	1	26	4.3	9
Vesper Sparrow	-	-	-	63	10.5	49
Chipping Sparrow	-	-	-	6	1.0	6
Field Sparrow	70	11.6	40	30	5.0	26
Swamp Sparrow	13	2.1	9	-	-	-
Song Sparrow	139	23.1	85	173	28.8	92

Comparative Evaluation of Bird Populations

Data were statistically analyzed to determine any significant differences in the bird populations between the two areas (Table 4). Of the 76 total species recorded, 70 were selected for this analysis. The Carolina Chickadee, White-breasted Nuthatch, White-eyed Vireo, Mockingbird, Black-crowned Night Heron, and Pintail were not included since only one individual of each species was recorded.

The results of the analysis, proving Resthaven to have a greater total number of species, also showed that the population difference between areas was significant for 19 species and highly significant for 13 species. A difference was considered significant if the computed F-statistic exceeded the critical F-value at the 95 percent confidence level ($F(.05,1,3) = 10.128$). A difference was considered highly significant if the F-statistic was greater than the critical F-value at the 99 percent confidence level ($F(.01,1,3) = 34.116$).

Fourteen of the 19 species which had significant differences were found in greater numbers at Resthaven; five were found in greater numbers at Erlin. Nine of the 13 species which had highly significant differences were more abundant at Resthaven; four were more abundant at Erlin.

Insufficient data were obtained for most birds, so a statistical analysis of habitat preferences was not made. Data are shown to give only a general indication of habitat preferences (Table 5).

Nearly all of the species which were found in significantly

Table 4. Analysis of Population Levels, by Species, for the Resthaven and Erlin Study Areas.

Species	F-statistic	Species	F-statistic
*Great Blue Heron	13.363+	Carolina Wren	1.000
*Green Heron	13.363+	**Gray Catbird	44.087+
Mallard	0.521	Brown Thrasher	0.043
Wood Duck	1.000	Robin	2.018
Redhead	2.882	Wood Thrush	6.173
Red-tailed Hawk	1.000	Veery	5.400
American Kestrel	6.000	*Cedar Waxwing	29.007+
Bobwhite	0.004	Starling	8.414
*Ring-neck Pheasant	25.000-	*Yellow-thr. Vireo	13.363+
*Killdeer	11.626-	*Red-eyed Vireo	15.473+
Rock Dove	3.387	*Warbling Vireo	26.814+
Mourning Dove	0.250	**Yellow Warbler	138.964+
**Yellow-bill Cuckoo	62.287+	*Common Yellowthroat	12.923+
Common Nighthawk	2.454	*Yellow-breasted Chat	23.419+
Chimney Swift	6. 387	American Redstart	4.800
Ruby-t. Hummingbird	1.000	*House Sparrow	25.212-
Belted Kingfisher	1.500	Bobolink	4.153
**Common Flicker	38.496+	*Eastern Meadowlark	14.694-
Red-bell. Woodpecker	2.000	**Red-wg. Blackbird	99.081-
Red-hd Woodpecker	6.547	Orchard Oriole	3.000
Hairy Woodpecker	1.000	**Northern Oriole	153.818+
*Downy Woodpecker	17.000+	**COmmOn Grackle	48.378 -
*Eastern Kingbird	13.363+	Brown-hd. Cowbird	0.538
Gt. Crest Flycatcher	0.166	Scarlet Tanager	4.800
Willow Flycatcher	6.260	Cardinal	2.674
*E. Wood Peewee	19.285+	Rose-br. Grosbeak	4.200
**Horned Lark	34.455-	**Indigo Bunting	75.999+
*Tree Swallow	14.852+	*American Goldfinch	26.231+
Purple Martin	2.842	*Roufous-sided Towhee	14.437+
Blue Jay	0.607	*Savannah Sparrow	18.939-
Rough-wg. Swallow	3.600	**Vesper Sparrow	99.414-
Barn Swallow	5.867	Chipping Sparrow	3.000
Common Crow	0.176	**Field Sparrow	66.666+
Tufted Titmouse	7.714	Swamp Sparrow	5.571
**House Wren	48.109+	Song Sparrow	3.541

* difference significant (95%)
** difference highly significant (99%)
\+ significantly greater numbers at Resthaven
\- significantly greater numbers at Erlin

Table 5. Habitat Preference as Determined by Frequency of Detection, by Species, for the Resthaven and Erlin Study Areas.

Species	Resthaven						Erlin				
	W	F	WD	GR	CR	FR	WD	CR	F	FR	W
Grt. Blue Heron	•	•	1	•	•	•	•	•	•	•	•
Green Heron	•	•	6	•	•	•	•	•	•	•	•
Blk.-cr. Nt. Heron	•	•	•	•	•	•	•	•	•	•	•
Mallard	31	•	•	•	•	•	•	22	•	•	•
Wool Duck	5	•	•	•	•	•	•	•	•	•	•
Redhead	14	•	•	•	•	•	•	•	•	•	•
Pintail	•	•	•	•	•	•	•	•	•	•	•
Red-tailed Hawk	•	•	1	•	•	•	2	•	•	•	•
American Kestrel	•	•	•	•	•	•	•	6	•	•	•
Bobwhite	•	•	•	•	•	•	•	3	•	•	•
Ring-neck Pheasant	•	•	•	•	•	•	•	8	•	•	•
Killdeer	•	•	•	•	2	•	•	•	•	•	•
Rock Dove	•	•	•	•	•	9	1	18	•	•	•
Mourning Dove	•	•	37	2	1	3	3	9	1	20	•
Yellow-bill Cuckoo	•	•	33	•	•	•	•	•	1	•	•
Common Nighthawk	•	•	•	•	•	•	•	•	•	•	•
Chimney Swift	•	•	•	•	•	•	•	•	•	3	•
Ruby-t. Hummingbird	•	•	•	•	•	•	•	•	•	•	•
Belted Kingfisher	•	•	6	•	•	•	•	•	•	•	•
Common Flicker	•	•	30	1	•	•	5	•	•	•	•
Red-bell. Woodpecker	•	•	3	•	•	•	•	•	•	•	•
Red-hd. Woodpecker	•	•	12	1	•	9	1	•	•	•	•
Hairy Woodpecker	•	•	3	•	•	•	•	•	•	•	•
Downey Woodpecker	•	•	30	•	•	•	1	•	•	•	•
Eastern Kingbird	•	•	4	2	•	•	•	•	1	2	•
Gt Crest. Flycatcher	•	•	5	•	•	•	13	•	•	•	•
Willow Flycatcher	•	11	6	33	•	•	•	•	6	•	•
E. Wood Peewee	•	•	20	•	•	•	9	•	•	•	•
Horned Lark	•	•	•	•	•	•	•	134	•	•	•
Tree Swallow	•	•	1	•	•	•	•	•	•	•	•
Rough-wg. Swallow	•	•	•	•	•	•	•	•	•	•	•

W--Water
F--Fencerow
WD--Woodland
GR--Grassland
CR--Cropland
FR--Farmland-Residential

Table 5. Habitat Preference as Determined by Frequency of Detection, by Species, for the Resthaven and Erlin Study Areas (continued).

Species	Resthaven						Erlin				
	W	F	WD	GR	CR	FR	WD	CR	F	FR	W
Barn Swallow											
Purple Martin											
Blue Jay			37			1	23	1		4	
Common Crow			2				2	3			
Carolina Chickadee			1								
Tufted Titmouse			10				1				
White-br. Nuthatch							1				
House Wren			114	1		1	20		2	36	
Carolina Wren			5								
Mickingbird											
Gray Catbird		12	62	14					9		
Brown Thrasher		1	6				1		3	3	
Robin		3	52	10	5	12	12	20	21	93	
Wood Thrush			31				3				
Veery			6								
Cedar Waxwing			35			1					
Starling		1	330	32	15	35	39	218	1	299	
White-eyed Vireo			1								
Yellow-thr. Vireo			6								
Red-eyed Vireo			28				3				
Warbling Vireo			39								
Yellow Warbler		1	36	38			2		2		
Com. Yellowthroat		1	33	30					19		
Yellow-br. Chat		3	15	18							
Am. Redstart			8								
House Sparrow			30	4	27	72	6	274	31	685	
Bobolink								9			
E. Meadowlark				3				52	3		
Red-wg. Blackbird		3	34	26	33		3	387	13	5	
Orchard Oriole				1							
Northern Oriole			94	3			10				
Common Grackle		2	91	111	99	10	12	35	2	154	
Brown-hd. Cowbird			18	11	22	2	5	1		3	
Scarlet Tanager			8								
Cardinal		1	38	4		1	9	2	7	5	
Rose-br. Grosbeak			7								
Indigo Bunting		1	58	122	4		4	4	22		

Table 5. Habitat Preference as Determined by Frequency of Detection, by Species, for the Resthaven and Erlin Study Areas (continued).

	Resthaven						Erlin				
Species	W	F	WD	GR	CR	FR	WD	CR	F	FR	W
Am. Goldfinch	.	.	13	116	1	.	1	55	1	.	.
Roufous-side Towhee	.	44	26	3	.	.	1	.	.	.	.
Savannah Sparrow	.	.	.	.	1	.	.	19	2	.	.
Vesper Sparrow	.	.	.	.	.	.	.	49	.	.	.
Chipping Sparrow	.	.	.	.	.	.	.	1	.	4	.
Field Sparrow	.	.	6	44	5	.	.	11	1	.	.
Swamp Sparrow	.	.	13	.	.	.	.	.	.	.	.
Song Sparrow	.	4	34	59	4	2	5	33	45	4	.

greater numbers at Resthaven were seen most frequently in the woodland habitats. The Yellow Warbler, Yellow-breasted Chat, Indigo Bunting, American Goldfinch, and Field Sparrow were seen most often in the grassland cover type. Considerably larger areas of both habitat types were found in the Resthaven study area than were found in the Erlin area. Woodland habitat covered 921.7 acres at Resthaven and only 136.4 acres at Erlin. Essentially no grassland was found in the Erlin area while 784.3 acres were found in the Resthaven area.

Of the birds found in significantly greater numbers at Erlin, only the House Sparrow was not seen most frequently in cropland habitats, this species being seen most often around barns and houses in the farmyard-residential areas. The Killdeer, Horned Lark, Eastern Meadowlark, Savannah Sparrow, and Vesper Sparrow were found almost exclusively in cropland habitats. Cropland in the Erlin area far exceeded that in the Resthaven area (2679.1 and 234.6 acres, respectively).

It appears that the type of habitat is a major factor in determining the species of birds that will be found in any given area. McElroy (1974) points out that birds are not distributed uniformly throughout any geographical area. Each species survives best in a certain type of habitat because of adaptations and specialization by generations of its ancestors. Burger (1973) states that variety of habitat is also a major factor in determining not only which species will be present, but also the number which will be present. Although the Erlin area offers a variety of habitats, most of this variety exists within the cropland cover type. The interspersion of cropland and non- cropland is minimal.

Resthaven has a good deal of habitat variety which includes not only cropland, but also much grassland, woodland, and water.

Another factor effecting bird populations is the stability of the habitat as pointed out by Dambach and Good (1940). Agricultural land with its crop rotation represents an unstable habitat for those species of birds which return by habit to approximately the same territory. Bird populations will tend to rotate with the crops (Dambach and Good 1940). Since the Erlin area is mainly cropland (88 percent), it represents rather unstable habitat for birds. Resthaven, however, represents fairly stable habitat from year to year and should have relatively stable bird associations.

Amount of Edge

Resthaven had a total of 662,800 feet of edge, most of which was water-woodland (394,600 feet) (Table 6). The Erlin area had a total of 359,560 feet of edge composed mainly of cropland-road (104,400) and cropland-cropland (88,700) (Table 7). The amount of edge on both areas, Resthaven in particular, was probably much more than that calculated due to the simplification of cover maps.

In addition to the kind and acreage of habitats present in the study areas, the kind and amount of edge within these habitats may have played a role in determining population levels. In their study of the effect of certain land use practices on populations of breeding birds in southwestern Ohio, Dambach and Good (1940) found that incresed edge produced increased populations

Table 6. Composition of "Edge" Within the Resthaven Study Area (in feet).

Habitats forming edge → / ↓	Woodland	Road	Grassland	Cropland
Woodland		41,200		
Grassland	69,400	58,800		
Cropland	15,800	5,800	12,000	
Water	394,600	6,800	25,000	
Fencerow		4,000	5,000	2,500
Farmyard–Residential	2,000	12,400	6,000	1,500

Total ± 662,800 feet

Table 7. Composition of "Edge" Within the Erlin Study Area (in feet).

Habitats forming edge → / ↓	Cropland	Pasture	Road	Farmyard–Residential
Woodland	36,000	4,000	2,500	1,000
Fencerow	57,400	9,000	60	
Cropland	88,700	10,500	104,400	
Water	400	1,000		
Farmyard–Residential	21,000	4,000	12,800	

Total = 359,560

of breeding birds by increasing the number of suitable territories available. The large difference between areas in the amount of edge may partially explain the population differences revealed in this investigation.

CONCLUSIONS AND RECOMMENDATIONS

The findings point out that upland game management as practiced at the Resthaven Wildlife Area increases populations of non-game birds by providing more suitable habitat than the surrounding agricultural areas.

Resthaven provided habitat for a larger variety of birds, although some species were discriminated against by the lack of cropland. The lack of cropland is not a drawback, however, since the agricultural land typical of northwestern Ohio provides plenty of suitable habitat for these species. The main benefit of Resthaven is its ability to increase those species which are not typically found in the intensely farmed areas of northwestern Ohio.

On the basis of the data compiled during this investigation, the following recommendations are submitted.

1. The Resthaven Wildlife Area should continue to be maintained in diversified cover types consisting of cropland, woodland, and water interspersed with permanent areas of grass and low shrubs.
2. More emphasis should be given to the maintenance and development of field borders, woodlots, and odd areas in the agricultural areas of northwestern Ohio to increase their quality as wildlife habitat.

3. Similar studies should be undertaken in the future to determine the effects of any change in land use practices on populations of non-game birds.

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